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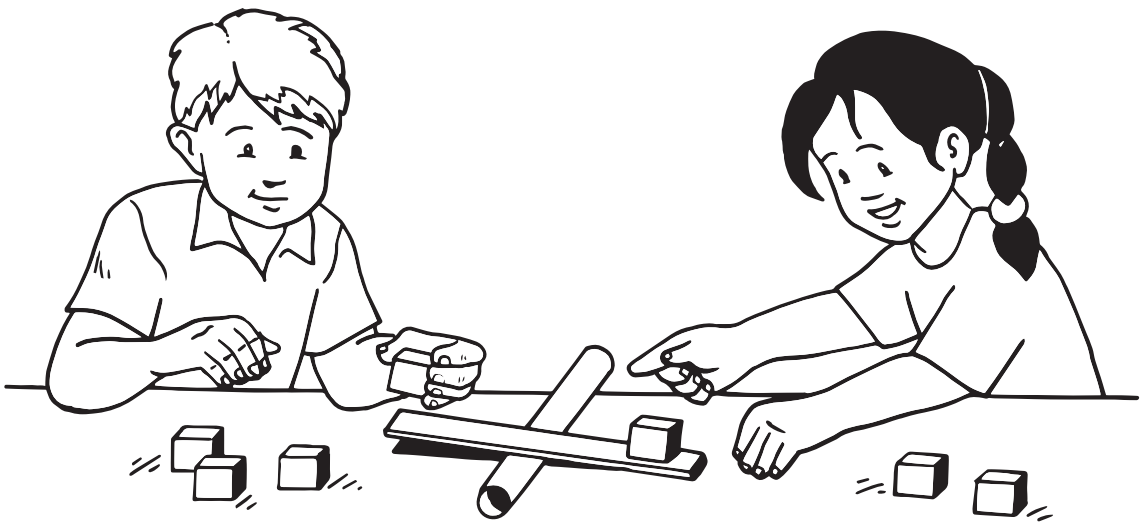
Introduction

Challenges



STEM Explorations

> "When a child arrives on the first day of kindergarten, he or she is already a scientist and already an engineer. That child is naturally curious about the world, motivated to learn about it, and anxious to find ways to make it better."
>
> *—2016 Science Framework for California Public Schools*

Science can be the most compelling subject in school. It is real, and it is an integral part of students' lives every day in every way—from the food they eat, to the weather they experience, to the toys and activities that engage them. The goal of this STEM (science, technology, engineering, math) resource is to help you capitalize on students' natural curiosity and guide them to use it in learning more about their world.

Each exploration in this book provides students with meaningful experiences and guides them to understand particular concepts through three sequential steps: a set of introductory and cross-curricular activities, two small-group centers, and a science or engineering challenge. This progression of activities is designed to introduce students to new concepts, to give them hands-on experience with those concepts, and then to challenge them to use what they have learned to solve a problem.

Introductory and Cross-Curricular Activities → **Centers for Hands-On, Small-Group Experiences** → **Science or Engineering Challenge**

* Introductory and Cross-Curricular Activities *

This section offers a guided, teacher-led introduction to new concepts and cross-curricular connection activities. The introduction helps students connect their own experiences to the challenge topic and then explore related concepts. The connections may include science, math, or language activities, as well as gross- and fine-motor movement activities.

* Centers for Hands-On, Small-Group Experience *

The centers provide hands-on experience where students explore concepts in small groups. Students may complete many of these centers independently, but some work better with an adult to lead and assist. As you read through each center activity description, think about how to set it up so it will work best for your class—you know your students best.

Air Power

Objectives

- Students will explore how air can exert pushing forces on objects and make them move.
- Students will create straw rockets and test and improve their designs.

Note: This exploration is best presented after students have some experience with forces and motion through the *Exploring Motion* and *Push and Pull* explorations.

STEM Focus

Physical Science

Pushes and pulls can have different strengths and directions.
Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it.

Engineering Design

Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.

Science and Engineering Practices

Plan and carry out investigations; analyze and interpret data; use mathematics and computational thinking

Crosscutting Concepts

Cause and effect; structure and function

Time Frame

- You can complete the Introduction in one class period of about 30 minutes.
- The centers should each take about 20 minutes.
- Allot approximately one hour for all steps of the Challenge. You may want to break it into two days, with initial testing on the first day and improvements and final testing on the second day.

Vocabulary

evidence	improve	pull	record	test
force	prediction	push	results	wind

Air Power

Introduction

1. Ask students to name the two types of **force** (push and pull) that they have studied.
2. Ask them to explain the difference between a **push** and a **pull**. (*A* push *moves something away from you and a* pull *moves something toward you.*)
3. Ask students what effects a force has on an object—if you push or pull something, what happens to it? Have students think about the question silently for about 30 seconds, and then have them turn to a partner and discuss their ideas.
4. Have volunteers share with the class what they discussed with their partners.
5. Lead students to see that when you push or pull something it can do one of the following things:

➜ start or stop moving

➜ change speed or direction

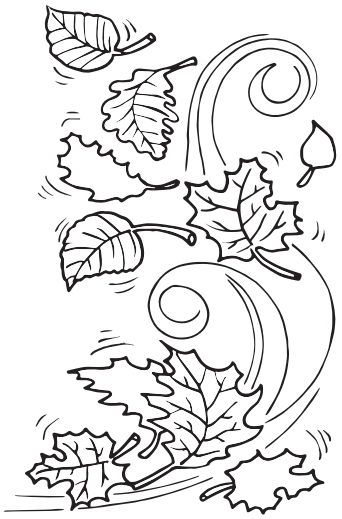
➜ change size or shape

Language Connection

Materials: whiteboard or chart paper and markers

1. On the whiteboard or chart paper, write the title *Wind Can....*
2. Ask students to think about a time they have experienced **wind**. Have them turn to a partner and share their experiences.
3. Have student volunteers share different things they have seen wind do and write them on the chart.
4. Ask students:
   —Can you see the wind? (*No.*)
   —Can you feel the wind? (*Yes.*)
   —Do you think the wind can push things or pull things? (*Yes*!)
   —If you can't see the wind, what is your **evidence** (*What do you see, hear, or experience?*) that the wind pushes or pulls things? (*We can feel wind pushing on us and we can see wind moving things.*)
5. Ask students what is actually pushing on them when they feel wind.
   Hint: It's all around us, all the time. (*Air*)
6. Tell students that they will be exploring how air can push things.

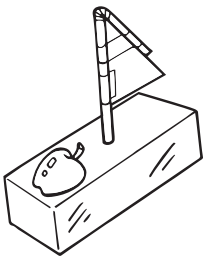
Wind Can...
make trees move
mess up my hair
blow trash around
make the clouds move



Air Power Centers

Safety Note: Each student should use his or her own straw at each center.

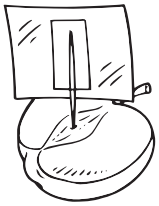
Center 1: Wind in Your Sails



Materials

- *Wind in Your Sails* center card (page 57) for each student
- a tub or bin about half-full of water
- straws, one per student
- ***for boat bodies:*** items that will float and not tip over, such as sliced sections of a pool noodle, empty juice boxes taped shut, or half an apple
- ***for masts:*** toothpicks or juice box straws ***Note:*** Skewers and craft sticks are too long and will make the boats top-heavy.
- ***for sails:*** squares, triangles, or rectangles of construction paper, cardstock, or foam

Setup



1. Arrange the tub of water and building materials in the center.
2. Provide a trash can for students to discard used straws.

Introduction

1. Ask students if they have ever seen a sailboat. How does it move? (*The wind pushes the sails.*)
2. Show students how to make a boat by taping a paper or a craft foam sail to a toothpick or straw mast and then pushing it into the body of the boat. ***Note:*** Be sure to place the mast in the center of the sail or the boat will spin in circles!
3. Go over the center card with students and then let them explore.

Center 2: Blowing Away

Materials

- *Blowing Away* (page 58) for each student
- ***small items to blow:*** pencils, tissues, blocks, paper clips, cotton balls, small paper cups, rocks, feathers, pennies, etc.
- pencils
- straws, one per student

Introduction

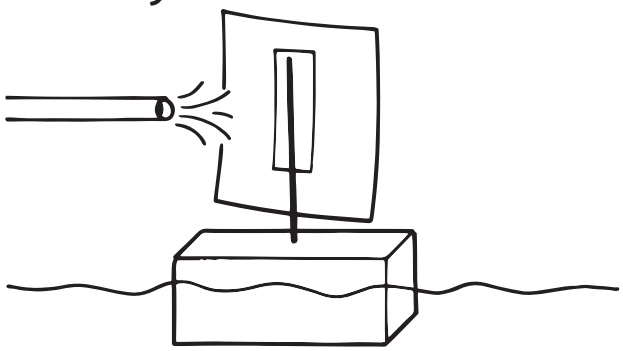
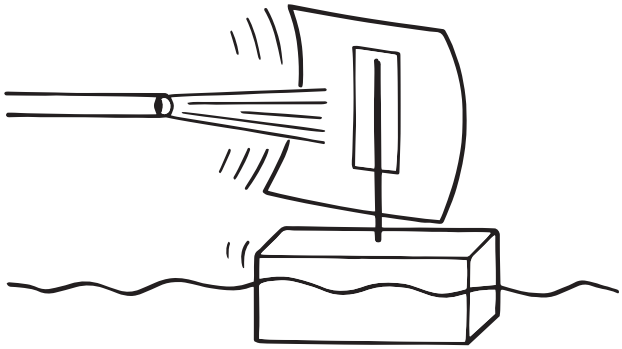
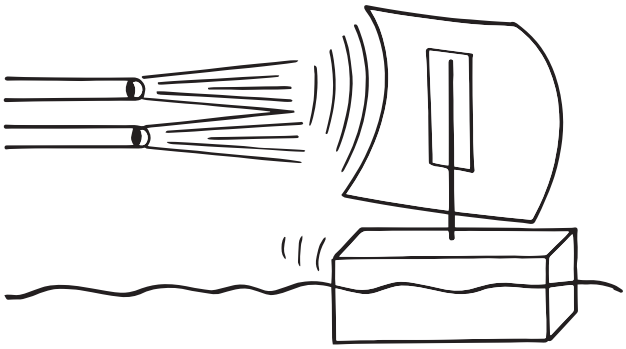
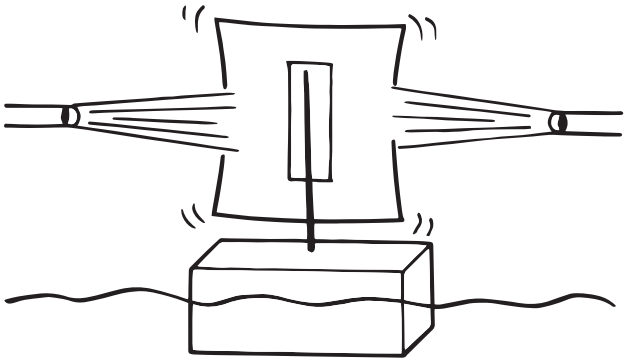
1. Choose an object to use for the demonstration. Ask students if they think the object will move when you blow on it with a straw. Explain that they will draw or write the name of each object they test in the first column of their center cards.
2. Show them where to mark their **prediction** (*what they think will happen*) on their *Blowing Away* center card.
3. Demonstrate blowing on the object. Have students try blowing from different angles, not just straight down.
4. Show students where to mark their **results** (*what happened*) on their center cards.

Name _____ Date _____

Wind in Your Sails

Directions

1. Build your sailboat.
2. Put the sailboat in the water and blow on the sail with a straw.
3. Use your straw to blow on your boat in the different ways shown in the pictures.
4. After you blow, draw an arrow on the boat to show which way it moved.

Blow softly. 	**Blow harder.** 
Two people blow at the same time. 	**Two people blow in opposite directions.** 

5. Circle your answer for each sentence:

The boat moves	**toward** **away from** you.
The air is	**pushing** **pulling** the boat.
The air and the boat are going	**the same** **the opposite** way.

Name _____ Date _____

Blowing Away

Directions

1. Write the name of each object in the first column.
2. **Prediction:** Will it move when you blow on it? Circle **Yes** or **No**.
3. Blow on the object with your straw.
4. **Results:** Did it move? Circle **Yes** or **No**.

Object	Prediction: Will It Move?	Results: Did It Move?
	Yes No	Yes No
	Yes No	Yes No
	Yes No	Yes No
	Yes No	Yes No
	Yes No	Yes No